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ACT SCIENCE QUIZ – MR. ARBO

Physics, Conflicting Viewpoints Format

Aristotle developed a system of physics based on what he thought occurred in nature. For example, he thought that if a stone is released from rest, it instantaneously reaches a speed that remains constant as the stone falls. He also believed that the speed attained by a stone falling in air varies directly with the weight of the stone. A 5-pound stone, for example, falls with a constant speed 5 times as great as that of a 1-pound stone. Aristotle also noted that stones dropped into water continue to fall, but at a slower rate than stones falling through air. To account for this, he explained that the resistance of the medium through which an object falls also affects the speed. Therefore, he said, the speed of a falling object also varies inversely with the resistance of the medium, and this resistance is the same for all objects.

Galileo disagreed with Aristotle's explanation. He generated the following arguments to refute Aristotle.

Consider a stake partially driven into the ground and a heavy stone falling from various heights onto the stake. If the stone falls from a height of 4 cubits, the stake will be driven into the ground, say, 4 fingerbreadths. But if the stone falls from a height of 1 cubit, the stake will be driven in a much smaller amount. Certainly, Galileo argued, if the stone is raised above the stake by only the thickness of a leaf, then the effect of the stone's falling on the stake will be altogether unnoticeable.

On the basis of a careful set of experiments, Galileo argued that the speed of an object released from rest varies directly with the time of fall. Also, the distance the object falls varies directly with the square of the time of fall if the effect of air resistance on the object is negligible. Thus, according to Galileo, objects actually fall with constant acceleration, and if air resistance is negligible, all objects have exactly the same acceleration.

Sample Items for Passage 2

41. Which graph accurately represents Galileo's theory of the relationship between speed and time for an object falling from rest under conditions of negligible air resistance?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A. | Graph A |  | C. | Graph C |
| B. | Graph B |  | D. | Graph D |

42. A book dropped from a height of 1 meter falls to the floor in *t* seconds. To be consistent with Aristotle's views, from what height, in meters, should a book 3 times as heavy be dropped so that it will fall to the floor in the same amount of time?

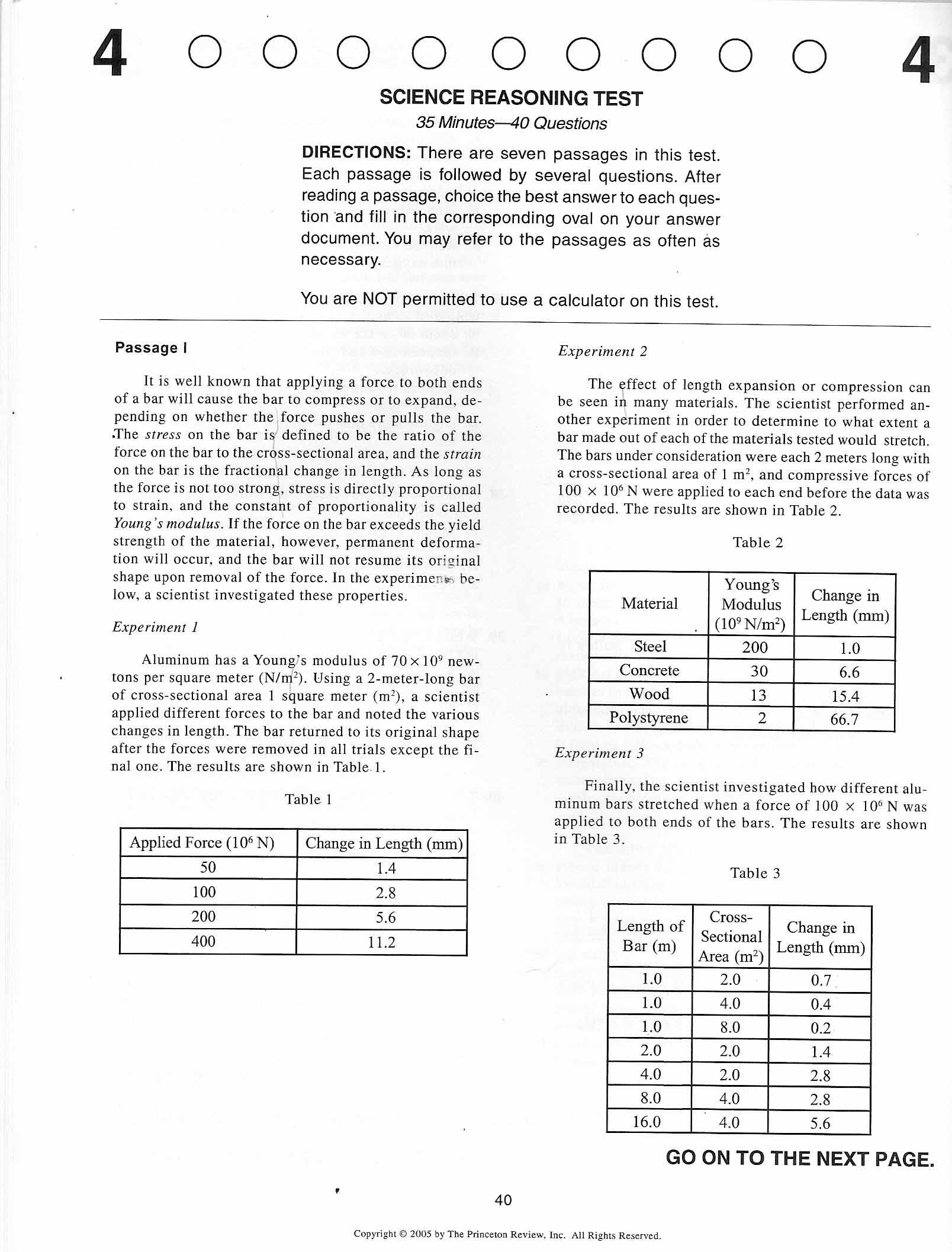
* 1. 1/9
  2. 1/3
  3. 1
  4. 3

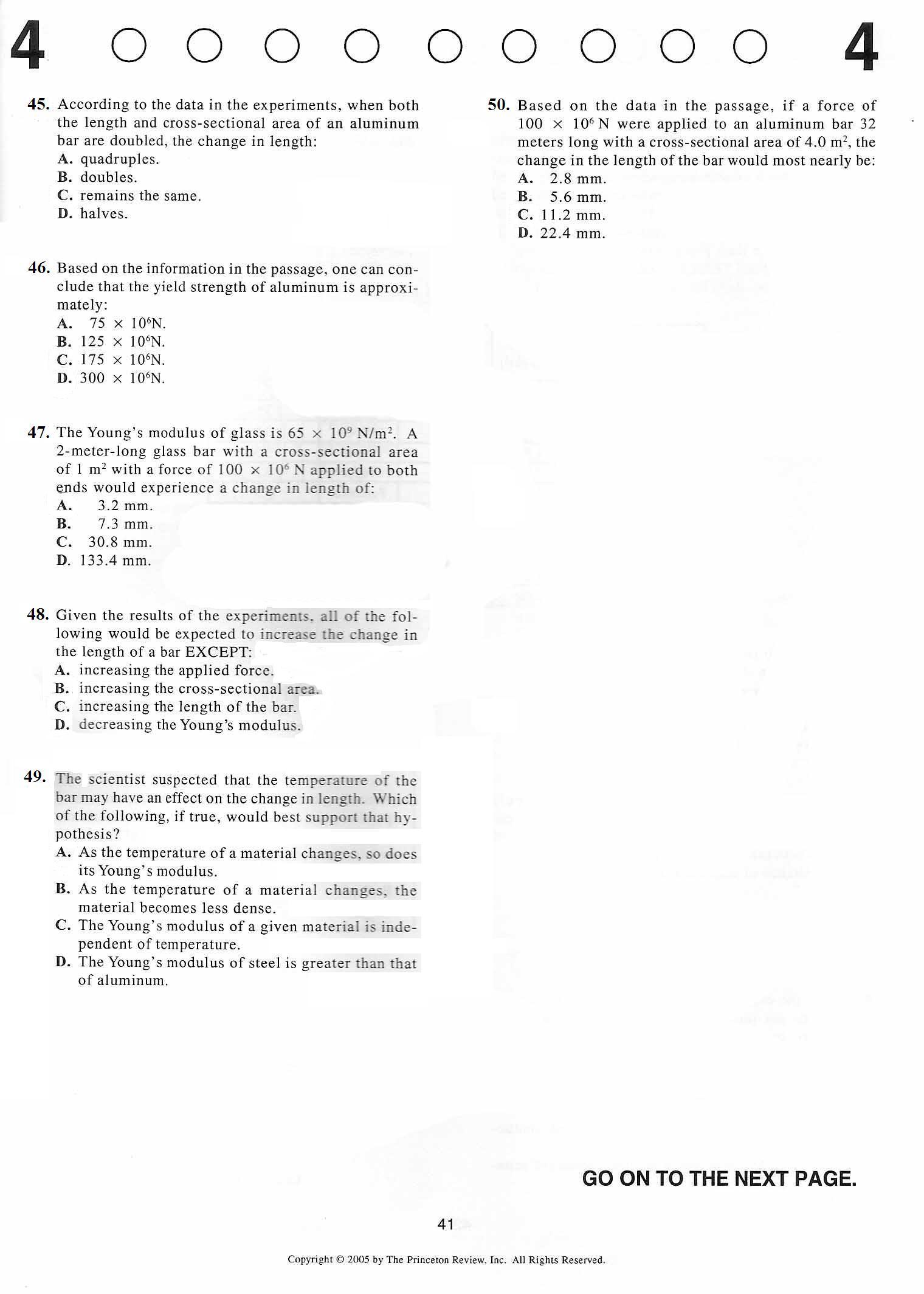
43. Suppose a heavy object falls to the ground in *t* seconds when dropped from shoulder height. According to Galileo, if air resistance were negligible, how many seconds would it take an object half as heavy to fall to the ground from the same height?

* 1. 0.5*t*
  2. 1.0*t*
  3. 1.5*t*
  4. 2.0*t*

44. A piece of putty weighing 2 pounds is dropped down a shaft from the top of a tall building; 1 second later, a 3 pound piece of putty is dropped down the shaft. According to Aristotle, what happens to the 2 pieces of putty if they fall for a relatively long time?

* 1. The separation between the 2 pieces constantly increases until they strike the ground.
  2. The separation between the 2 pieces is constant until they strike the ground.
  3. The heavier piece catches up to the smaller piece, and the 2 pieces travel together with the speed of the heavier piece.
  4. The heavier piece catches up to the smaller piece, and the 2 pieces travel together with a speed faster than the speed of either.





41. A. 42. D. 43. B. 44. D.

45. C 46. D 47. A 48. B 49. A 50. C